

## THE DEVELOPMENT AND GENERAL BIOLOGY OF CREOPHILUS VILLOSUS GRAV.

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As the largest and most conspicuous of our native Staphylinidæ, *Creophilus villosus* Grav. is of unusual interest. This paper proposes to discuss the results of observations on the development, general biology, and certain aspects of anatomy; a summary of work carried on for several years past.

### GENERAL HABITS

Adult specimens of the beetle are generally found on or about the carcasses of animals lying in the open country. Although they may also be found in wooded regions, the species is primarily one of open fields, where it may occur in great numbers. Specimens sometimes are attracted from a considerable distance; for instance, one flew into the open window of an elevated car in the heart of Chicago. Although the beetles apparently orient to decaying material chiefly in flight, they will also emerge from their subterranean resting-places if a carcass is not too far distant.

Very few adults occur in midsummer. They appear in greatest numbers in the Chicago region in late May, and again in somewhat lesser numbers in September. The following record of numbers at various periods of the summer will indicate this more clearly:

May 2 .....	12	May 22 .....	35
May 8 .....	18	July 19 .....	5
May 11 .....	19	Aug. 2 .....	5
May 12 .....	34	Aug. 27 .....	1
May 15 .....	24	Oct. 6 .....	11

Unfortunately I have no exact records for September, but the number for October given above indicates a decline due to the coming of cold weather. It should also be remembered that these records are not of a few observations during one season, but merely samples of what has been observed over a period of years.

*Creophilus* feeds on fly maggots and other insects found on and about decaying matter. This has been proved not only by laboratory experiments but by observations in the field. When pressed, the adults will often attack decaying meat, but the larvæ never have been observed doing so. Both larvæ and adults are highly predatory; of some thirty larvæ, kept in a large container of earth, only five escaped being eaten and so reached maturity. When placed together in a small container, both adults and larvæ "snap" vigorously at one another in a manner which is almost repulsive to the onlooker.

Both larvæ and adults feign death, when touched or suddenly exposed, by flexing the abdomen ventrally until the body forms a ring. This condition never lasts more than a few seconds, nor can it, like that of some insects, be readily reinduced.

Mating usually occurs with the copulatory organs alone in contact, so that the insects lie with their heads pointed in opposite directions. Sometimes the stronger of the pair drags the protesting mate over the ground as it runs. Mating may last at least an hour, although external factors easily disrupt the union.

#### DESCRIPTION OF STAGES

*Egg*: Length, 2.0–3.0 mm.; width, 1.5–2.0 mm.; ovoid, symmetrical, nearly prolate; opaque, white to cream; thin-shelled; collapsing when preserved. (Fig. 1.)

*Larva*: When newly emerged the larva is from 5.5–6.0 mm. in length, with the greatest width 1.2–1.5 mm. Prior to pupation it reaches a length of 25.0–30.0 mm., with a width of from 5.0 to 7.0 mm. The *head* of the larva, like that of the adult, is circular and compressed; the eyes consisting of four simple ocelli on either side of the head (Fig. 6); the antennæ, placed far forward, almost between the jaws, are 3-segmented and about 2.0 mm. long. Dorsally the *prothorax* is broad, sclerotized, and dark; the sternal plate is triangular, with the apex caudad, and covers only the anterior half of the prothorax. The *mesothorax* and *metathorax* are essentially similar. Dorsally each is supplied with a pair of dark, sclerous plates; bilaterally arranged, and separated by a space about .01 mm. in width. There is no ventral sclerotization. All the *abdominal* segments, excepting the terminal one, are simi-

lar. Each has, like the thoracic segments just described, two dorsal plates, separated by a space of about .05 mm.; two bilaterally arranged, hexagonal, ventral plates; two epipleural plates, on either side of the segment, the larger anterior and elongated, the smaller posterior and circular; and on either side one subpleural, elongated plate. All these plates are dull brown and sparsely set with short hairs. The intervening spaces appear white from subcuticular fat. The *terminal* abdominal segment differs from the others in being heavily sclerotized throughout, as well as dark and hirsute; the cerci, which are attached dorsally and project dorso-caudally, are 3.0 mm. in length, sclerotized and hirsute; they are 3-segmented, the 2nd segment being considerably shorter than the other two. Ventrally the terminal abdominal segment forms a tubular prolongation (2.0 mm.) through which the anus opens. (See Fig. 5, and the student drawing, Fig. 6.)

The *legs* of the larva are all similar. The subcoxa is reduced and apparently double; the coxa large, elongated, and broad at the base; the trochanter prominent and sclerous; the femur moderately long and enlarged distally; the tibia narrow and about the same length as the femur (1.0 mm.), the tarsus a mere spike (0.5 mm.). All parts of the leg are set with spines, those on the femur being arranged in two ordered rows. (These are not shown in Fig. 8.)

The *mesothoracic spiracle* is conspicuously large; the *metathoracic* located between the 2nd and 3rd pairs of legs, very small. The *abdominal spiracles* are moderately conspicuous, but decrease regularly in size as the termination of the abdomen is approached. They are all sclerous and dark.

*Pupa*: Length, 15.0 mm.; greatest width, 5.0 mm.; translucent brown when newly formed, gradually becoming black. The *legs*, *posterior wings*, and *jaws* are folded against the sternum; the *antennæ* cross the bases of the jaws just under the eyes to fold back, the distal ends directed caudad. The *elytra* are folded close to the body over the wings, with their distal ends directed caudo-ventrally, but not completely covering the wings; in fact not reaching beyond the pleura. The *abdominal spiracles* are dorsal, elevated, and conspicuous. The *eyes* are somewhat darker than the rest of the body. A conspicuous, narrow, transverse ridge,

nearly black, and set with a single row of hairs evenly spaced, traverses the anterior part of the pronotum. (Figs. 3 and 4.)

*Adult*: The adult is too well known to require description. When newly emerged it is very glossy. (Fig. 2.)

#### DEVELOPMENTAL BEHAVIOR

The duration of incubation is about 48 hours. An average taken from twenty-two specimens places the larval stage in summer at about 23 days. The average duration of the pupal stage is 12 days. This makes the total duration of development approximately 37 days.

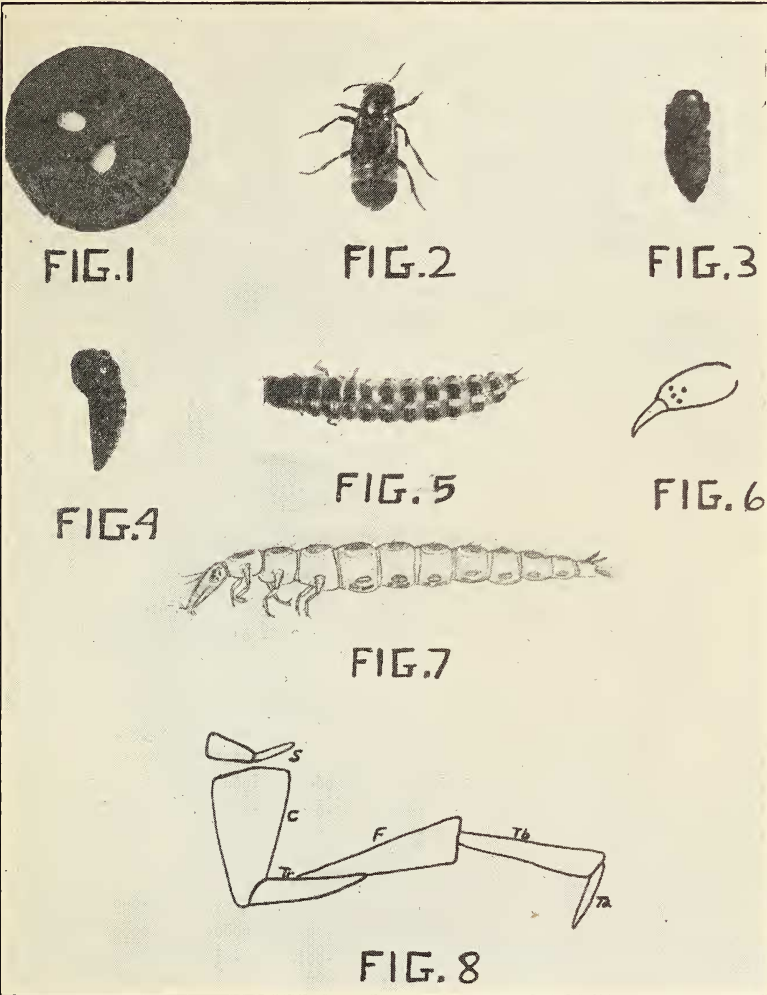
Although eggs may be deposited upon the surface of the ground, it is more usual to find them from 1-5 cm. below the surface. I have not seen larvæ emerge from eggs, but those emerging from molt are nearly white. It requires about 3 hours for the larva to reach full coloration after ecdysis. The number of instars is not known.

Larvæ normally remain pretty much below the surface of the soil. When about to pupate the larva shortens, thickens, and remains partially flexed ventrally. It may remain in this condition 2 or 3 days before the final transformation to pupa. The nature of the soil permitting, the insect forms an oval cavity in which the pupa lies. This is probably produced by movements of the larva prior to pupation.

I wish to extend a word of thanks to my pupil, Wm. Gedzun, for permission to use the drawing constituting Fig. 7.

#### PLATE I

- Figure 1. *Creophilus villosus*, eggs.  
 Figure 2. *C. villosus*, adult.  
 Figure 3. *C. villosus*, ventral aspect of pupa.  
 Figure 4. *C. villosus*, lateral aspect of pupa.  
 Figure 5. *C. villosus*, larva.  
 Figure 6. *C. villosus*, sketch of larval head, left lateral aspect, showing the ocelli.  
 Figure 7. *C. villosus*. Student sketch, left lateral aspect, of larva.  
 Figure 8. *C. villosus*. Larval leg. The parts indicated are: S, subcoxa; C, coxa; Tr, trochanter; F, femur; Tb, tibia; Ta, tarsus.



CREOPHILUS VILLOSUS